CLAIMS

What is claimed is:

1. A composite structural material comprising:

a non-solid composite section filled with a structural foam for reducing weight of the composite structural material; and

a solid section coupled to said non-solid composite section for providing an area for structural attachment to the composite structural material wherein an interface region adjoining said non-solid composite section to said solid section is radiused to reduce stress when said structural foam is bonded thereto thereby increasing a load capability of the composite structural material before delamination and cracking of said structural foam occurs.

2. The composite structural material of claim 1 wherein said structural foam comprises a polymethacrylimide foam.

3. The composite structural material of claim 1 wherein said structural foam comprises a metallic foam.

4. The composite structural material of claim 1 further including:

a first layer of material common to said non-solid composite section and said solid section forming a first major surface of the composite structural material; and

a second layer of material common to said non-solid composite section and said solid section forming a second major surface of the composite structural material wherein said structural foam bonds to and forms a layer between said first and second layer of material in said non-solid composite section.

5. The composite structural material of claim 4 wherein said solid section further includes one or more layers of solid material between said first and second layers of material.

6. The composite structural material of claim 1 wherein said first and second layer of material comprises graphite and epoxy.

7. The composite structure of claim 1 wherein said first and second layer of material comprises a metal.

8. The composite structure of claim 1 wherein said first and second layer of material comprises a plastic.

9. The composite structure of claim 1 wherein a curvature of said radius in said interface region adjoining said non-solid composite section to said solid section is greater than twice a dimension of an average cell size of said structural foam.

10. The composite structure of claim 9 wherein a bullnose shape is formed in said interface region adjoining said non-solid composite section to said solid section, and wherein said structural foam is shaped similarly to said bullnose shape and bonded to said interface region.

11. A composite structural material comprising:

a non-solid composite section including an inner structural foam layer;

a first solid section wherein a wall thickness of said non-solid composite section is greater than a wall thickness of said first solid section; and

a first transition section coupling said non-solid composite section to said first solid composite section, said first transition section including said inner structural foam layer wherein said first transition section has a wall thickness substantially equal to said non-solid composite section where said first transition section adjoins said non-solid composite section, wherein said first transition section has a wall thickness substantially equal to said first solid section where said first transition section adjoins said solid section and wherein said first transition section includes at least one curved major surface for reducing stress on said inner structural foam layer and compensating for a difference in said wall thickness between said non-solid composite section and said first solid section.

12. The composite structural material as recited in claim 11 wherein said first solid section is a structural mounting point for the composite structural material and wherein an interface region adjoining said first transition section to said first solid section is radiused, said interface region forming a minor curved surface interior to the composite structural material for increased loading capability of the composite structural material before delamination and cracking of said inner structural foam layer occurs.

13. The composite structural material as recited in claim 12 further including:

a first layer of material common to said non-solid composite section, said first transition section, and said first solid section, said first layer of material forming a first major surface of the composite structural material; and

a second layer of material common to said non-solid composite section, said first transition section, and said first solid composite section, said second layer of material forming a second major surface of the composite structural material wherein said inner structural foam layer bonds to and is between said first and second layer of material.

14. The composite structural material as recited in claim 13 wherein said first and second layers of material comprise graphite and epoxy.

15. The composite structural material as recited in claim 12 wherein said first solid section further includes one or more layers of material between said first and second layers of material.

16. The composite structural material as recited in claim 12 wherein said radiused interface region has a radius greater than twice a dimension of an average cell size of a structural foam used in said inner structural foam layer.

17. The composite structural material as recited in claim 11 further including:

a second solid section; and

a second transition section coupling said non-solid composite section to said second solid section, said second transition section including said inner structural foam layer wherein said second solid section is a structural mounting point for the composite structural material.

18. The composite structural material as recited in claim 11 wherein a structural foam used in said inner structural foam layer comprises a polymethacrylimide foam.

19. A method for increasing a strength of a composite structural material under load that includes a non-solid foam filled section and at least one solid section for structural mounting comprising the steps of:

forming a curved surface in an interface region interior to the composite structural material where the non-solid foam filled section adjoins the at least one solid section; and

bonding a structural foam in said non-solid structural foam filled section to said interface region wherein said curved surface reduces stress on said structural foam is reduced thereby increasing a loading capability of the composite structural material before delamination and cracking of said structural foam occurs.

20. The method for increasing a strength of a composite structural material under load that includes a non-solid foam filled section and at least one solid section for structural mounting as recited in claim 19 further including the steps of:

forming the composite structural material such that a first layer of material is common to said non-solid foam filled section and said at least one solid section to form a first major surface of the composite structural material;

forming the composite structural material such that a second layer of material is common to said non-solid foam filled section and the at least one solid section to form a second major surface of the composite structural material wherein said structural foam bonds to and is between said first and second layers of material in said non-solid foam filled section; and

forming one of said first or second layer of material having a curved surface in a region where said non-solid foam filled section transitions to the at least one solid section to further reduce stress on said structural foam.

21. The method for increasing a strength of a composite structural material under load that includes a non-solid foam filled section and at least one solid section for structural mounting as recited in claim 20 further including a step of forming the at least one solid section having at one or more layers of solid material between said first and second layers of material.